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INVENTORY OF WETLAND USING REMOTE SENSING FOR THE PROPOSED OAHE IRRIGATION UNIT IN EASTERN SOUTH DAKOTA

For

National Aeronautics and Space Administration

Remote Sensing Institute
South Dakota State University
Brookings, South Dakota 57007

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By
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For
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Office of University Affairs
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ABSTRACT

An inventory of wetlands for the area included in the proposed Oahe Irrigation Project was conducted to provide supplemental data for the wildlife mitigation plan. This report including the data summaries follows a report which documented the interpretation techniques as presented by Best, Moore, and Brewster[2] for inventorying small, predominantly Type I wetlands in the low-relief terrain of the Lake Dakota Plain. Wetland habitat in over 310,000 acres in the Oahe irrigation district was inventoried. There were 5305 wetlands representing 7530 acres, 589 acres of natural drains, and 1545 acres of stream habitat in the area. The data were stored and tabulated in a computerized spatial data analysis system. The data summaries are provided for various spatial stratification. The project was conducted by the Remote Sensing Institute with consultation with the U.S. Fish and Wildlife Service with funds provided by a NASA Office of University Affairs Grant NGL 42-003-007.

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[2] Best, R.G., D.G., Moore, and W.G. Brewster. 1976. Color-Infrared Aircraft Photography to Identify and Classify Wetlands in the Lake Dakota Plain of Eastern South Dakota. Report No. SDSU RSI-76-03, Remote Sensing Institute, South Dakota State University, Brookings, South Dakota 57006.

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INTRODUCTION

In recent years, there has been a continuing trend towards increased agricultural production with a subsequent loss of wildlife habitat. Shaw and Fredine (1971) estimated that at least 45-million acres of the original 127-million acres of natural wetlands in the United States have been drained or otherwise destroyed.

Losses of wetland habitat in South Dakota are following the national trend. About 200,000 acres of land in the Lake Dakota Plain of Eastern South Dakota are scheduled for irrigation through development of the initial stage of the Oahe Unit - a multipurpose water resource project (Fig. 1). The general plan for the Oahe Unit involves diverting water from the Oahe Reservoir through a system of pumping plants, main and lateral canals, and several regulatory reservoirs to the Lake Dakota Plain. An assessment of the quantitative effect of the Oahe Unit on the natural prairie wetlands is the responsibility of the U.S. Fish and Wildlife Service (FWS), under authority of the Fish and Wildlife Coordination Act. To lessen the adverse effects of certain projects such as the Oahe Unit, programs have been developed for the maintenance and restoration of wetland habitat. These programs include treaties and agreements on migratory birds and fishes, the Fish and Wildlife Coordination Act, state and federal wetland acquisition programs, Environmental Policy Act and its associated environmental assessments, Accelerated Wetland Loan Fund Act, Water Bank Act, Coastal Zone Management Act, and Endangered Species Act (Jahn 1975).

Wetlands which hold water for a short time following snow melt or heavy rainfall are common throughout the proposed area. These wetlands are incompatible with sprinkler or flood irrigation and will be drained or leveled during irrigation development. Quantitative wetland data are required to formulate a plan for maintaining or replacing these wetland habitat losses. Aerial photography is recognized as a primary source of morphometric information on water bodies. However, accurate inventories of many types of wetlands are difficult because of their small size, intermittence of standing water, masking effects of agricultural practices, and the availability of timely data. Best, Moore, and Brewster (1976) concluded that the presence of hydrophytes as well as water regime parameters could be interpreted on color-infrared photography improving the accuracy of an inventory and classification of temporary prairie wetlands.

Traditional inventories have used low-altitude black and white panchromatic photos and are generally limited to areas the size of a county. These data are often collected during summer months for purposes other than wetland inventories which makes it difficult to interpret temporary wetlands which no longer contain standing water. The color-infrared film depicts a greater variety of tones representing variations in vegetation species and soil moisture and allows greater accuracy of interpretation. In addition, high quality color-infrared data collected in the spring when many temporary wetlands contain water improves the interpretor's capability to recognize and map the small and temporary wetlands. As discussed by Best et al (1976), many Type 1 wetlands in vegetated fields could be missed if they did not contain standing water.

Conventional determination of area with either a compensating polar planimeter or a series of grids, as well as manual cataloging of these data, consumes considerable labor and provides delays in completing of inventories over large regions if considerable manpower is not readily available.

The objective of the present study was to provide a current wetland inventory of the Oahe Unit using high-altitude color-infrared aircraft imagery by developing a reliable photo interpretation procedure and a system of cataloging, summarizing, and analyzing large quantities of quantitative wetland data. Black and white enlargement prints of RB-57 imagery were used for the actual inventory and an electronic planimeter system and computer programs were developed to rapidly process the wetland inventory data. Data were supplied to the FWS for formulation of a mitigation plan for the project area.

STUDY AREA

The proposed Oahe Unit is located in the Lake Dakota Plain which is part of the James River Lowland and is characterized by a lack of relief. The flatness results from the deposition of sediments in Glacial Lake Dakota, which existed during the last deglaciation of the region (Flint, 1955). Local relief in many places is less than 10 ft. The area is drained by the James River dividing the unit into two parts, which for the purpose of this report, will be called the West Lake Plain and the East Plain (Fig. 1). Approximately 310,000 acres which occur in a checkerboard pattern are included in the Oahe Irrigation district; however, only about 200,000 acres are suitable for irrigation development.

WETLAND HABITAT DEFINITIONS

Since the term "wetlands" can and is defined in various ways, wetlands are defined in this report as depressions which contain shallow and sometimes temporary or intermittent waters. In a preliminary investigation Best et al. (1976) documented the use of color-infrared photography to classify wetlands according to the "types" defined by Shaw and Fredine (1971). Wetland types with similar characteristics were grouped and several other types of comparable habitat were included to augment the biological interpretation of the wetland inventory. The seasonally flooded basins (Type I) and inland fresh meadows (Type II) were included in a single group because in both cases the basins are generally without water during the growing season and most are tilled and planted to agricultural crops (Fig. 2). Inland shallow fresh marshes (Type III), inland deep marshes (Type IV), and inland open fresh water (Type V), were grouped because, in a normal year, the basin soils are water-logged or covered with water during the growing season making them incompatible with agricultural crops (Fig. 3). Artificial wetlands, including dugouts, stock dams and lagoons, were grouped and considered separately from natural wetland habitat even though most were located within or along the periphery of natural wetlands (Fig. 4).

Two additional types of habitat, which are important to the waterfowl in the Lake Dakota Plain area and which will be altered because of project construction, were interpreted and kept separate from other categories of wetlands. Semipermanent and permanent streams in the irrigation district support stands of hydrophytes and provide waterfowl with brood-rearing habitat when less permanent wetlands are dry (Fig. 5). The James River was not

included as part of the inventory but its tributaries were. Intermittent natural drainage ways (Fig. 6), which included areas in natural drains with habitat similar to Type I, were also maintained in a separate category.

PROCEDURES

General contacts between RSI and U.S. Fish and Wildlife Services (FWS) personnel led to the identification of the need for a current wetland inventory in the Lake Dakota Plain of Eastern South Dakota. Discussions led to the fact that mitigation plans were to be formulated but current data were not adequate for planning. Remote sensing technology was suggested by RSI personnel as a possible means for providing an updated assessment of wetlands.

An overview of the procedures and work implemented to accomplish the assessment are as follows:

1) Preliminary meetings were held with the FWS to identify data needs for wetland inventory for mitigation plans.

2) Color-infrared RB-57 imagery for Lake Dakota Plain was obtained and black and white enlargements were prepared for study area.

3) Interpretation techniques were developed and documented by Best et al. (1976).

4) Data were photo interpreted and transferred to acetate overlays for determination of area in different wetland types.

5) Spatial Data (automatic planimetering) methods were developed and applied for areal measures.

6) Programs were written to analyze the spatial data by various strata.

7) Maps and tabular data were furnished to FWS for formulation of a mitigation plan.

The NASA RB-57 aircraft collected color-infrared imagery of the Oahe Unit and surrounding area on 27 June 1975 (Mission 312) at 60,000 ft. above ground level at an original scale of ≈1:120,000. Black and white enlargement prints were exposed from the color-infrared transparencies. Each print was scaled during printing to correct scale differences in the original imagery and to prepare an interpretation product of suitable scale. Forty enlargement prints were randomly selected to determine the scale and variability. The mean scale was 1:12,590 with a coefficient of variability of 1.0%. The variance of scale was not considered as a significant source of error in the area measurement. Field checking and low-altitude aerial reconnaissance of a selected sample proved no misclassification of habitat type and no significant differences in the delineation of basin extent for the 50 wetlands checked.

Interpretations were transferred to clear acetate overlays and area measurements were made on the Spatial Data (Data Color 703-Fig. 7) unit of RSI's Signal Analysis and Dissemination Equipment (SADE). Included in the Spatial Data unit are a closed circuit television camera, a constant illumination light box and an electronic digital planimeter which measures relative areas of one or more of 32 density levels when used in conjunction with the color display monitor. The total area of each of four wetland types was measured as a percentage of the 160-acre unit cell. To determine the accuracy of the electronic digital planimeter, forty quarter sections were randomly selected from the irrigation district and the wetland areas were measured with a compensating polar planimeter. The mean difference between the wetland acres per cell as measured on Spatial Data and that measured with the planimeter was 0.08+.07 acres at the 0.5 confidence level.

The number of wetlands of each type as well as their area measurements for each unit cell was encoded into a computerized data bank. Also encoded into the data bank were the legal description, dominant irrigation class, and spatial distribution. The computerized spatial analysis system was used to produce tabular summaries and spatial displays of the data required for the optimal biological interpretation of the wetland inventory.

RESULTS AND DISCUSSION

Table 1 is a summary of each habitat stratified by three areas; the area scheduled for irrigation in Brown County, the area east of the James River in Spink County, and the area west of the James River in Spink County, respectively. Wetland totals are separated from stream and natural drainage habitat types. It was assumed that wetlands will be destroyed because of their incompatability with irrigation techniques; however, most streams and drains will be used as main or on-farm drains and will not be destroyed, but will be greatly altered by increased flows from irrigation runoff. In order to aquire a more detailed comprehension of habitat data, they were stratified into township units and summarized in Table 2. The habitat data were catalogued and can be recalled by the legal description of quarter-section cells. A complete listing of data by legal description is included in Appendix B.

The Oahe irrigation district consists of approximately 310,000 acres, but project guidelines allow for only 160 acres per farm (≈190,000 acres total) to be irrigated annually. About 70% of the irrigation district has no limitations to irrigation development (irrigation classes 1, 2, 3) and another 10% (irrigation class 5) may possibly be irrigated if deep plowing

TABLE 1. REGIONAL SUMMARY OF WETLAND HABITAT DATA.

	IRRIGATION DISTRICT ACRES	TYPE I&II		TYPE III,IV&V		ARTIFICIAL WETLANDS		TOTAL WETLAND		STREAMS	NATURAL DRAINS
		NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	ACRES	ACRES
BROWN COUNTY	93580.	2183.	2027.0	7.	640.0	89.	41.2	2279.	2708.2	649.9	157.0
EAST LAKE PLAIN SPINK COUNTY	115250.	1239.	1266.4	1.	67.0	98.	25.5	1338.	1358.9	442.4	243.4
WEST LAKE PLAIN SPINK COUNTY	101960.	1532.	1676.5	13.	1736.5	143.	50.2	1688.	3463.2	453.0	188.4
TOTALS	310790.	4954.	4969.8	21.	2443.5	330.	116.9	5305.	7530.2	1545.3	588.8

TABLE 2. WETLAND HABITAT DATA SUMMARIZED BY TOWNSHIPS.

TOWNSHIP	RANGE	IRRIGATION DISTRICT ACRES	TYPE III		TYPE III, IV, V		ARTIFICIAL WETLANDS		TOTAL WETLAND		STREAMS	NATURAL DRAINS
			NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	ACRES	ACRES
114N	61W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
114N	62W	240.	4.	10.7	0.	0.0	1.	0.2	5.	10.9	0.0	0.0
114N	63W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
114N	64W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
114N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
115N	61W	480.	7.	7.2	0.	0.0	0.	0.0	7.	7.2	0.0	0.0
115N	62W	4100.	50.	78.2	0.	70.7	0.	1.9	58.	150.8	0.0	6.9
115N	63W	6080.	42.	36.1	0.	0.0	16.	3.5	58.	39.6	15.2	13.8
115N	64W	50.	1.	5.8	0.	0.0	0.	0.0	1.	5.8	0.0	0.0
115N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
116N	61W	480.	20.	13.4	0.	0.0	1.	0.2	21.	13.6	0.0	0.0
116N	62W	13310.	92.	132.3	1.	39.0	13.	3.1	106.	174.4	29.1	57.6
116N	63W	12500.	104.	143.9	2.	143.3	31.	6.7	137.	343.9	0.0	10.8
116N	64W	3860.	60.	35.3	0.	0.0	6.	1.3	66.	36.6	19.0	0.0
116N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
117N	61W	3480.	14.	8.4	0.	0.0	2.	0.5	16.	8.9	56.5	16.1
117N	62W	16880.	89.	101.8	0.	0.0	8.	2.2	97.	103.2	79.7	24.2
117N	63W	13110.	245.	196.1	0.	0.0	5.	1.5	250.	197.6	4.1	23.8
117N	64W	10710.	225.	205.8	0.	0.0	16.	3.8	241.	209.6	47.9	24.9
117N	65W	160.	5.	0.3	0.	0.0	0.	0.0	5.	0.3	0.0	0.0
118N	61W	4400.	47.	43.3	0.	0.0	4.	1.0	51.	44.3	11.2	10.7
118N	62W	8240.	132.	99.8	0.	0.0	7.	1.7	139.	101.5	25.7	11.5
118N	63W	13560.	143.	190.8	2.	10.4	15.	4.0	160.	213.2	4.1	15.0
118N	64W	16360.	244.	261.9	1.	10.6	19.	5.2	264.	277.7	174.9	34.4
118N	65W	640.	54.	14.1	0.	0.0	0.	0.0	54.	14.1	26.1	0.0
119N	61W	3560.	58.	53.7	0.	0.0	7.	2.0	65.	55.7	0.0	0.0
119N	62W	10080.	117.	178.1	0.	0.0	11.	3.1	128.	181.2	9.8	52.5
119N	63W	8560.	90.	86.1	0.	0.0	2.	0.6	92.	88.7	14.3	7.0
119N	64W	15860.	182.	127.1	2.	381.1	19.	7.0	203.	515.2	150.8	28.0
119N	65W	1680.	27.	10.6	0.	0.0	3.	0.8	30.	11.4	24.8	0.0
120N	61W	9110.	71.	31.8	0.	0.0	4.	1.3	75.	33.1	0.0	0.0
120N	62W	16640.	152.	125.7	0.	0.0	13.	3.0	165.	128.7	145.8	46.1
120N	63W	9270.	91.	149.5	0.	0.0	3.	0.8	94.	150.3	55.2	10.8
120N	64W	14970.	160.	488.1	4.	950.1	23.	19.0	187.	1457.2	0.0	38.3
120N	65W	2320.	85.	55.8	2.	190.3	5.	1.3	92.	247.4	0.0	0.0
121N	61W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
121N	62W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
121N	63W	5080.	36.	21.0	0.	0.0	2.	0.4	38.	21.4	11.1	11.7
121N	64W	7320.	46.	89.3	1.	209.4	9.	4.7	56.	303.4	50.9	16.0
121N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
122N	61W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
122N	62W	5090.	37.	82.6	0.	0.0	4.	1.0	41.	83.6	68.3	20.7
122N	63W	13320.	165.	81.7	0.	9.9	3.	1.2	168.	92.8	144.8	30.5
122N	64W	6980.	129.	191.3	0.	9.6	2.	0.5	131.	201.4	46.4	14.7
122N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
123N	61W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
123N	62W	10180.	164.	171.8	1.	21.3	19.	16.5	184.	201.6	0.0	15.8
123N	63W	13430.	449.	359.4	0.	0.0	13.	4.6	462.	364.0	76.2	29.8
123N	64W	40.	0.	0.0	0.	0.0	1.	0.1	1.	0.1	0.0	0.0
123N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
124N	61W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
124N	62W	8750.	207.	217.7	1.	31.8	6.	1.5	214.	251.0	16.1	5.4
124N	63W	11040.	389.	376.3	0.	0.0	4.	10.4	395.	386.9	147.1	0.0
124N	64W	1580.	225.	119.6	0.	0.0	1.	0.3	226.	119.9	2.7	1.8
124N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
125N	61W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
125N	62W	5450.	69.	59.1	1.	358.0	9.	2.1	79.	419.2	19.7	3.4
125N	63W	3480.	191.	152.5	0.	0.0	10.	2.8	201.	155.3	55.4	9.2
125N	64W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
125N	65W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
126N	61W	0.	0.	0.0	0.	0.0	0.	0.0	0.	0.0	0.0	0.0
126N	62W	720.	25.	15.2	0.	0.0	3.	0.8	28.	16.0	0.0	0.0
126N	63W	160.	33.	82.9	0.	0.0	0.	0.0	33.	82.9	0.0	0.0
126N	64W	160.	18.	6.4	0.	0.0	1.	0.3	19.	6.7	0.0	0.0
TOTALS		318790.	4954.	4969.8	21.	2443.5	330.	116.9	5305.	7530.2	1545.3	588.8

techniques are used. Much of the remaining land (irrigation class 6) is in the flood plain of the James River and its tributaries and has only a limited potential for irrigation development. Table 3 is a summary of data stratified by the dominant irrigation class within each cell. Table 4 is a further stratification of these data including both the regional distribution and the dominant irrigation class. Stratification of data by irrigation classes provides the basis for an assessment of the initial impact and allows location of those areas which will be most adversely affected.

Further processing of the data can produce spatial displays (maps) or raw data or data summaries. Printer overstrike displays (see Fig. 1) can be obtained or data can be plotted (computerdrawn) to match any scale. A color-encoded display which was produced via the color display monitor of the SADE system is included in Fig. 8.

The methods developed in this study provide a reliable inventory in the short time frame required for an accurate evaluation of temporary wetland habitat. Table 5 is an estimate of time required to complete the inventory (not including technique development).

TABLE 3. SUMMARY OF WETLAND HABITAT DATA BY IRRIGATION CLASS.

DOMINANT IRR. CLASS	IRRIGATION DISTRICT ACRES	TYPE I&II		TYPE III, IV&V		ARTIFICIAL WETLANDS		TOTAL WETLAND		STREAMS	NATURAL DRAINS
		NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	ACRES	ACRES
1,2,&3	221380.	3033.	2901.4	10.	943.7	199.	78.7	3242.	3923.8	891.4	415.6
5	29710.	587.	560.1	1.	15.7	35.	13.1	623.	589.1	47.2	26.2
6	42870.	717.	972.6	9.	1473.9	80.	20.4	806.	2466.9	516.6	127.9
UNKNOWN	16830.	617.	535.7	1.	10.2	17.	4.5	635.	550.4	90.1	19.1
TOTALS	310790.	4954.	4969.8	21.	2443.5	330.	116.9	5305.	7530.2	1545.3	588.8

TABLE 4. WETLAND HABITAT DATA SUMMARIZED BY REGION AND IRRIGATION CLASS.

	IRRIGATION DISTRICT ACRES	TYPE I&II		TYPE III, IV&V		ARTIFICIAL WETLANDS		TOTAL WETLAND		STREAMS	NATURAL DRAINS
		NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES	ACRES	ACRES
BROWN COUNTY											
1,2,&3	61280.	1275.	1039.2	1.	123.7	58.	28.5	1334.	1191.4	315.9	104.8
5	6830.	178.	145.6	0.	8.7	9.	6.5	187.	160.8	33.8	2.4
6	13020.	219.	388.7	5.	497.4	10.	3.0	234.	889.1	230.2	30.7
UNKNOWN	12450.	511.	453.5	1.	10.2	12.	3.2	524.	466.9	70.0	19.1
EAST LAKE PLAIN SPINK COUNTY											
1,2,&3	85770.	828.	843.6	0.	60.0	60.	15.7	888.	919.3	264.2	188.3
5	16800.	286.	247.5	1.	7.0	18.	4.4	305.	258.9	9.4	17.6
6	11280.	89.	148.7	0.	0.0	20.	5.2	109.	153.9	168.8	37.5
UNKNOWN	1400.	36.	26.6	0.	0.0	1.	0.2	37.	26.8	0.0	0.0
WEST LAKE PLAIN SPINK COUNTY											
1,2,&3	74330.	930.	1018.7	8.	760.0	81.	34.5	1019.	1813.2	311.3	122.5
5	6080.	123.	167.0	0.	0.0	8.	2.4	131.	169.4	4.0	6.2
6	18570.	409.	435.2	4.	976.5	50.	12.2	463.	1423.9	117.6	59.7
UNKNOWN	2980.	70.	55.6	0.	0.0	4.	1.1	74.	56.7	20.1	0.0
TOTALS	310790.	4954.	4969.8	21.	2443.5	330.	116.9	5305.	7530.2	1545.3	588.8

TABLE 5

ESTIMATE OF TIME REQUIRED TO COMPLETE INVENTORY OF 310,000 ACRES*

	labor	equipment
Familiarization with area	80 man hours	
Interpretation	240 man hours	
Verification	40 man hours	8 hrs. AIRCRAFT
Area measurement**	50 man hours	23 hrs. SPATIAL DATA
Data storage & retrieval (tabular summaries, lists displays)	15 man hours	3 min CPU IBM 370/145
TOTAL	425 man hours	

* The estimates do not include time required to procure and catalog original imagery.

** Based on the time required to measure the wetlands in 40 quarter sections compensating polar planimeter ≈ 480 man hours would be required to make measurements for the 310,000 acre area using this method. Considerably more time would be required to produce data summaries and displays without the aid of a computerized storage and retrieval system.

CONCLUSIONS

The remote sensing technique provided reliable information in a suitable format in a timely manner. The advantage of the technique is especially apparent when the results can be spatially tabulated for every part of the study area which is in contrast to survey results that are based on a statistical sample and can not later be stratified or analyzed beyond the initial randomization when selecting the samples. These data are stored in a data system and can be easily and quickly retrieved for any additional analysis without the limitations imposed because of the non-stratified (or misstratified) randomization process.

The area measurement technique developed in this project proved to be an accurate and timely technique for the large area that was inventoried. Computer programs written to store and analyze the spatial data greatly reduced the time required to produce data summaries and spatial displays.

The land area not covered in this survey (those adjacent and interspersed lands within the potential irrigated acreage) could be inventoried with data already available to the State of South Dakota. This information could be merged with the spatial data base developed with this initial activity. As additional information needs for environmental impact statements, selection of mitigation sites, etc., are required, the information would be available in a timely manner. As illustrated in this document, a large area can be evaluated in a short time.

LITERATURE CITED

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Flint, R.F. 1955. Pleistocene geology of Eastern South Dakota. U.S. Geol. Survey Prof. Paper 262 U.S. Gov't Printing Office, Washington, D.C. 173 pp.

Jahn L.R. 1975. A summary statement. Proceedings of the National Wetland Classification and Inventory Workshop. FWS/OBS 76/09 355 pp.

APPENDIX A

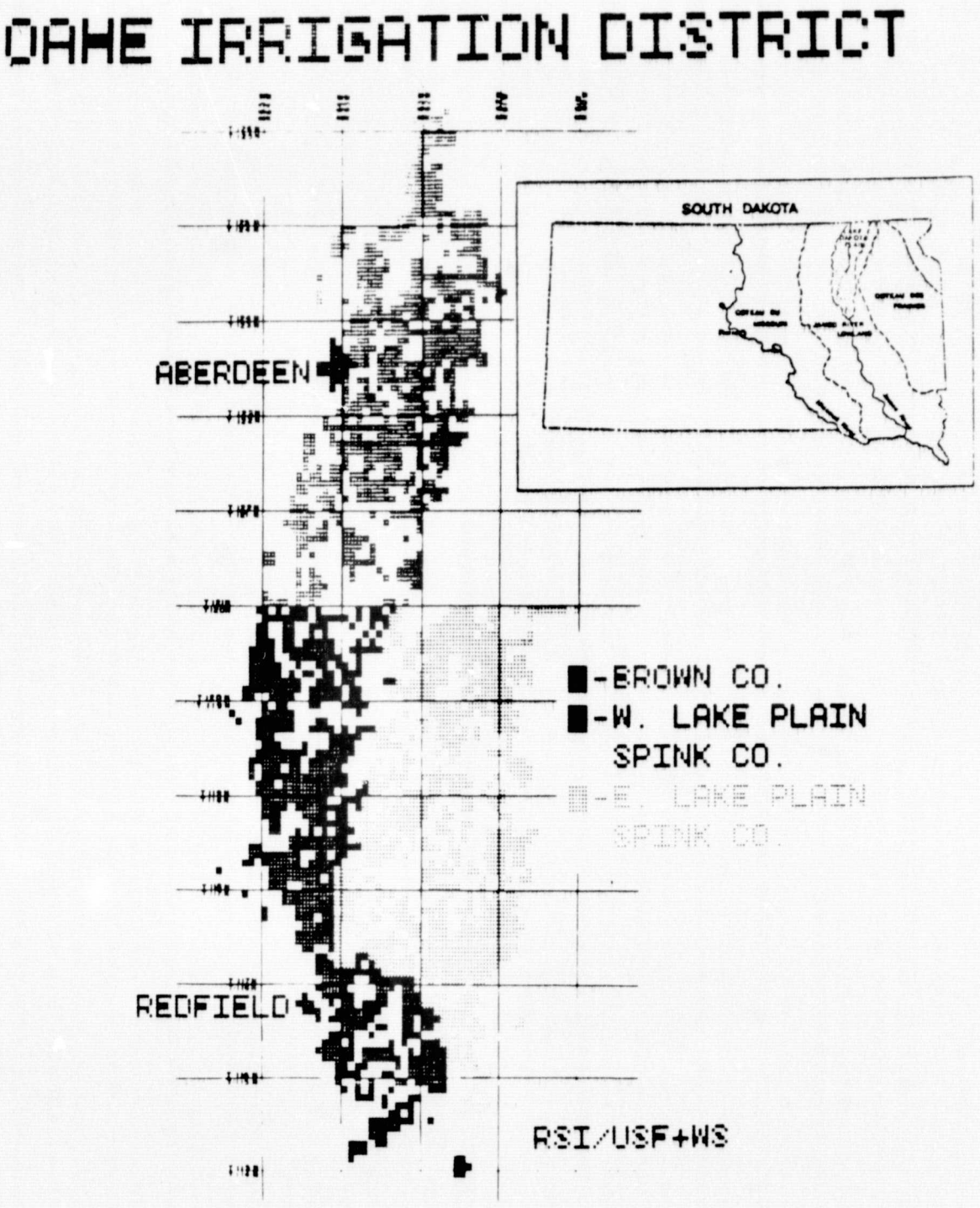

Fig. 1 Computer overstrike display of the land proposed to be irrigated in the Oahe irrigation district.

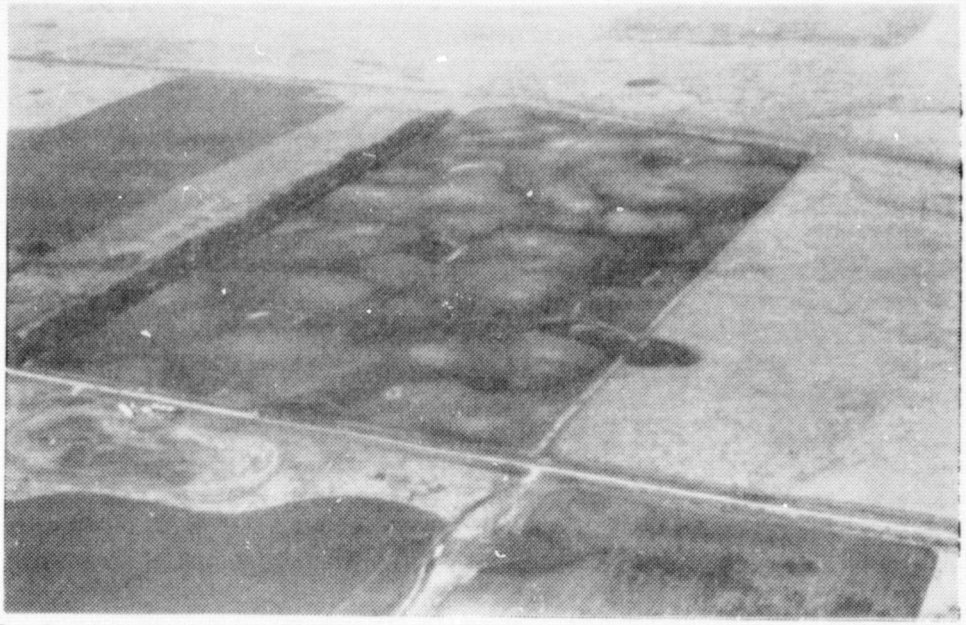

Fig. 2 Aerial oblique photograph of Type I wetlands in Oahe Unit. Note the location of basins is within agricultural fields.

Fig. 3 Aerial oblique photograph of Type IV wetlands. Note presence of emergent vegetation and location of agricultural crops only on the periphery.

Fig. 4 Aerial oblique photograph of artificial wetlands (dugouts). Note their location within Type I wetland.

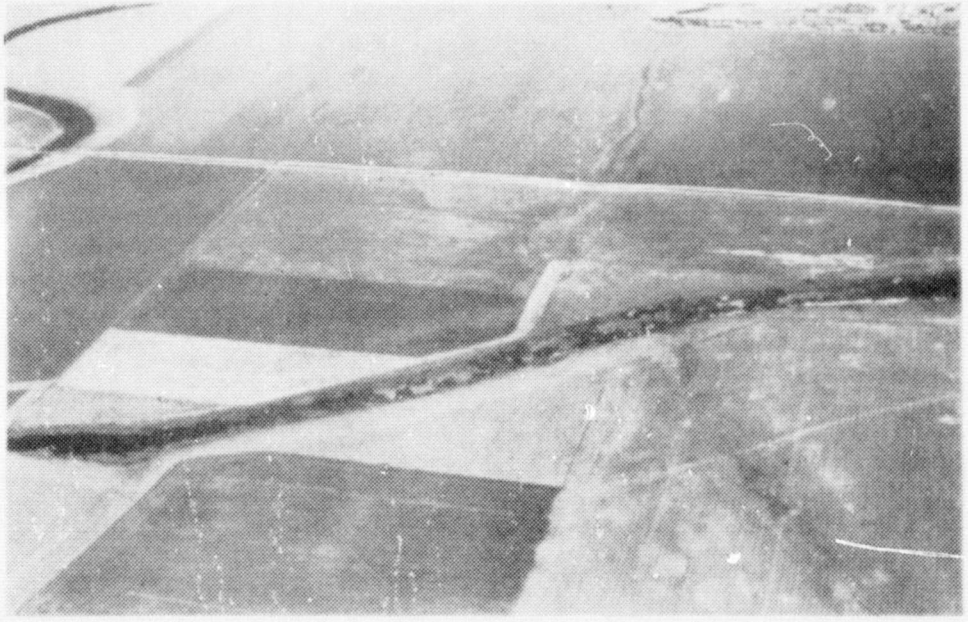

Fig. 5 Aerial oblique photograph of stream characteristic of the irrigation district.
Note the presence of emergent vegetation in stream channel.

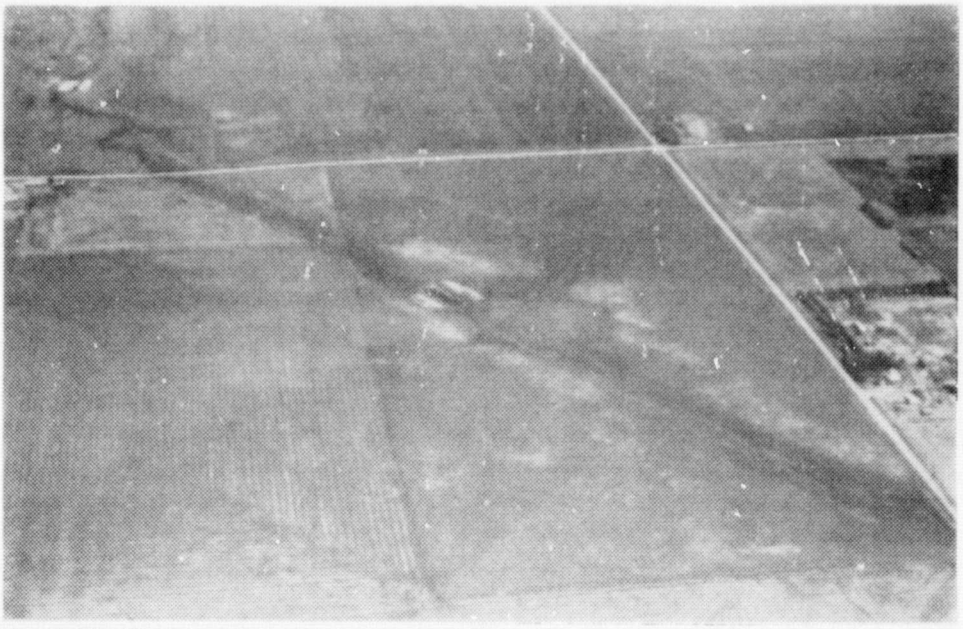

Fig. 6 Aerial oblique photograph of intermittent natural drain. Note similarity to Type I habitat.

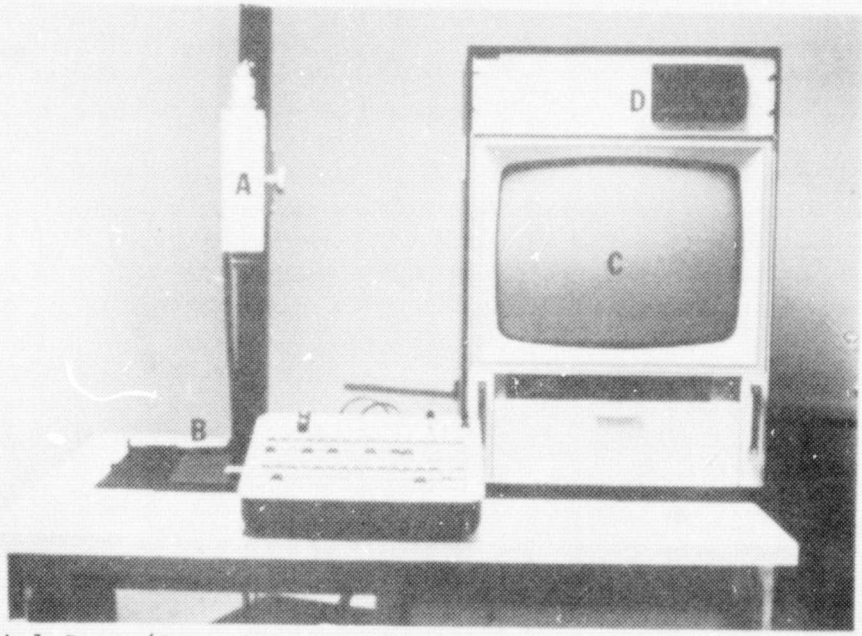

Fig. 7 Spatial Data (Data Color 703) unit used for area measurements.

A. Television camera
B. Constant illumination light box
C. Color display monitor
D. Electronic digital planimeter

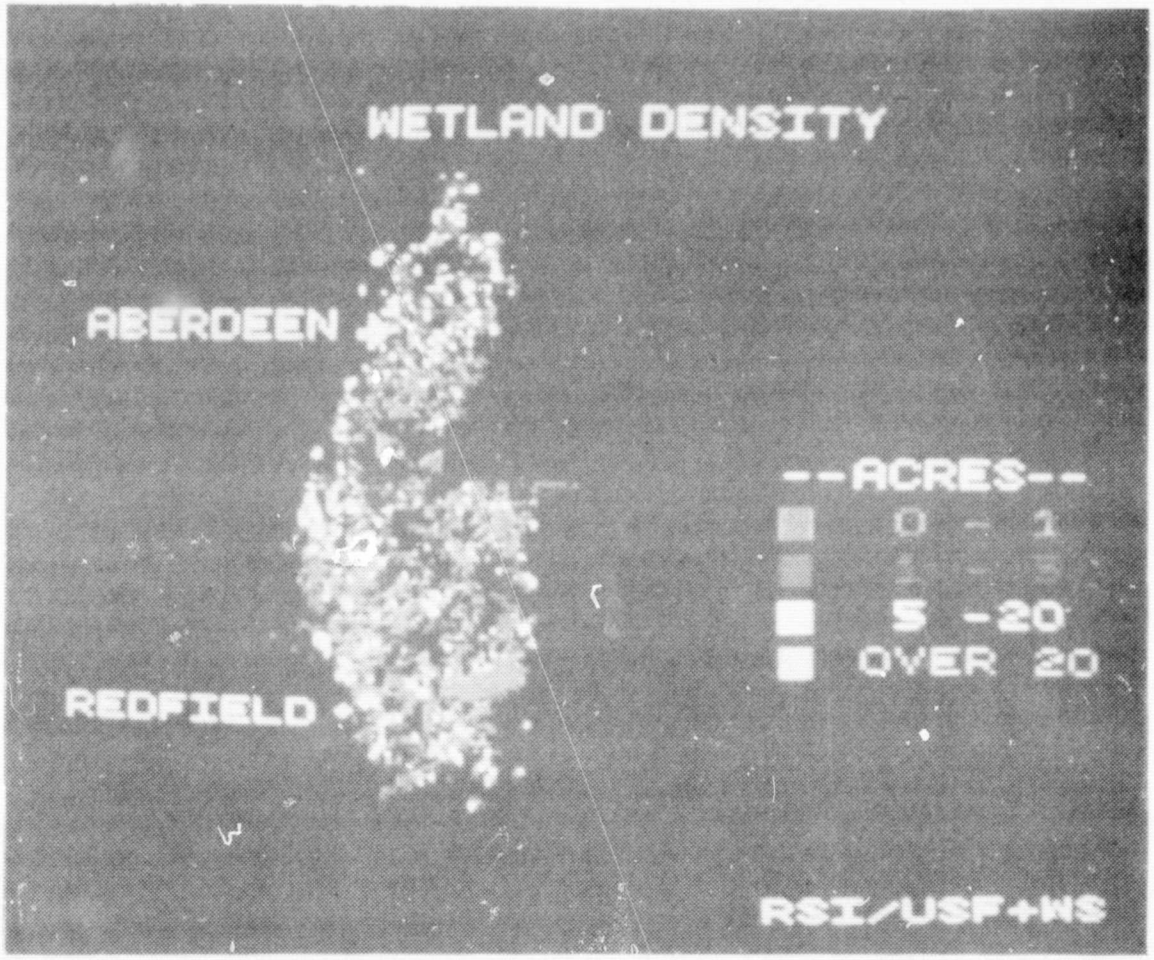

Fig. 8 Example color-encoded display produced via color display monitor of SADE system.

APPENDIX B

DATA LISTING

1/	2/	3/	4/	5/	6/	7/	8/	9/	10/	11/	12/	13/	14/	15/
125	63	36	B	160	4.0	31.0	0.0	0.0	0.0	0.0	1.0	0.2	1	1
125	63	36	A	160	2.0	9.0	0.0	0.0	0.0	0.0	1.0	0.3	1	1
125	63	35	C	80	32.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	5	1
125	63	35	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
125	63	36	C	80	2.0	37.4	0.0	0.0	0.0	0.0	1.0	0.3	6	1
125	62	30	B	160	2.0	0.8	0.0	0.0	1.3	0.0	0.0	0.0	1	1
125	62	30	A	160	3.0	0.6	0.0	0.0	2.1	0.0	1.0	0.3	1	1
125	62	29	B	80	3.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
125	62	30	C	160	4.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
125	62	30	D	160	2.0	0.1	0.0	0.0	0.0	0.0	2.0	0.3	1	1
125	62	31	B	160	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
125	62	31	A	160	0.0	0.0	0.1	1.3	0.0	0.0	0.0	0.0	1	1
125	62	32	B	160	0.0	0.0	0.1	21.1	0.0	0.0	0.0	0.0	6	1
125	62	32	A	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
125	62	32	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1

1/ Township
2/ Range
3/ Section
4/ Quarter Section B A
C D
5/ Irrigation District Acres
6/ Number of Type I & II Wetlands
7/ Type I & II Acres
8/ Number of Type III, IV, & V Wetlands
9/ Type III, IV, & V Acres
10/ Acres of Intermittent Natural Drainageways
11/ Acres of Permanent and Semi-permanent Streams
12/ Number of Artificial Wetlands
13/ Acres of Artificial Wetlands
14/ Dominant Cell Irrigation Class
1 = Class 1, 2, & 3
5 = Class 5
6 = Class 6
7 = Unknown
15/ Region
1 = Brown County
2 = East Lake Plain; Spink County
3 = West Lake Plain; Spink County

122	64	10	C	40	2.0	10.1	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	64	10	D	160	1.0	18.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	8	A	160	3.0	14.7	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	64	8	D	120	17.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	7	C	160	15.0	1.3	0.0	0.0	0.0	1.3	0.0	0.0	6	1
122	64	7	D	160	1.0	0.1	0.0	0.0	0.0	11.2	0.0	0.0	7	1
122	64	12	A	80	6.0	0.8	0.0	0.0	0.0	0.0	1.0	0.2	5	1
122	64	12	C	30	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	7	1
122	64	12	D	120	4.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	6	B	160	9.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	63	5	B	160	4.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	4	C	160	8.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	4	D	160	4.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	5	C	160	3.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	5	D	120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	7	A	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	8	B	160	1.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	7	C	160	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	7	D	160	9.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	8	C	80	1.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	8	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	3	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	4	C	160	4.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	4	D	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	3	C	160	5.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	3	D	160	3.0	1.0	0.0	0.0	0.0	0.0	1.0	0.4	6	1
122	63	9	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	10	B	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	10	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	9	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	9	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	10	C	160	3.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	10	D	160	5.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	2	B	160	9.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	2	A	160	2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	1	B	160	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	2	C	160	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	2	D	160	11.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	1	C	160	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	11	B	160	5.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	11	A	80	2.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	12	B	160	6.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	12	A	160	2.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	11	C	160	7.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	11	D	160	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	12	C	160	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	12	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	6	B	160	1.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	6	A	160	1.0	0.2	0.0	0.0	0.0	0.0	1.0	0.2	6	1
122	62	5	B	160	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	5	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	5	C	160	1.0	1.3	0.0	0.0	0.0	0.0	1.0	0.3	1	1
122	62	5	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	7	A	160	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	1	1
122	62	8	B	160	3.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	8	A	160	3.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	7	C	160	1.0	0.2	0.0	0.0	18.9	0.0	0.0	0.0	1	1
122	62	7	D	160	1.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	8	C	160	2.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	8	D	160	2.0	2.2	0.0	0.0	0.0	0.0	1.0	0.3	1	1
122	62	4	A	120	1.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	3	B	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	9	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	9	A	130	3.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	10	B	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	9	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	9	D	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	64	15	B	80	0.0	0.0	0.1	9.6	0.0	0.0	0.0	0.0	6	1
122	64	15	A	160	8.0	3.5	0.0	0.0	0.0	0.0	0.0	0.8	5	1
122	64	15	C	80	3.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	64	22	B	160	1.0	6.1	0.0	0.0	0.0	9.6	0.0	0.0	5	1
122	64	21	C	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	64	22	D	160	5.0	9.6	0.0	0.0	9.6	0.0	0.0	0.0	6	1
122	64	13	A	160	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	23	B	160	3.0	2.9	0.0	0.0	0.0	10.9	0.0	0.0	6	1
122	64	24	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	24	A	160	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	23	C	160	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	1	1
122	64	24	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	24	D	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	18	B	160	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	1	1
122	63	18	A	160	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	1	1
122	63	17	B	160	1.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	17	A	160	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	19	C	160	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	1	1
122	63	17	D	160	4.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	19	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	20	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	19	D	160	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	20	C	160	3.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	20	D	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	16	A	160	1.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	16	A	160	4.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	15	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	15	A	160	1.0	0.4	0.0	0.0	2.4	0.0	0.0	0.0	7	1
122	63	16	C	160	7.0	2.6	0.0	0.0	0.0	0.0	1.0	0.3	5	1
122	63	16	D	160	4.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	63	15	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	15	D	160	0.0	0.0	0.0	0.0	4.3	10.4	0.0	0.0	6	1
122	63	21	B	160	4.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	5	1

122	63	22	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	22	A	160	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	6	1
122	63	22	C	160	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	1	1
122	63	22	D	160	0.0	0.0	0.0	0.0	0.0	19.0	0.0	0.0	6	1
122	63	14	B	160	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0	1	1
122	63	13	A	80	4.0	3.2	0.0	0.0	0.0	9.6	0.0	0.0	6	1
122	63	14	C	160	0.0	0.0	0.0	0.0	0.0	2.9	1.0	0.3	1	1
122	63	13	D	160	0.0	0.0	0.0	0.0	0.0	15.7	0.0	0.0	1	1
122	63	23	B	120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	24	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	24	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	18	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	17	B	160	1.0	27.8	0.0	0.0	0.0	0.0	1.0	0.2	1	1
122	62	17	A	160	4.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	18	D	160	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	6	1
122	62	17	C	160	2.0	28.0	0.0	0.0	0.0	0.5	0.0	0.0	1	1
122	62	17	D	160	1.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	62	19	B	160	0.0	0.0	0.0	0.0	0.0	12.5	0.0	0.0	1	1
122	62	20	B	80	0.0	0.0	0.0	0.0	0.0	13.6	0.0	0.0	6	1
122	62	20	A	160	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	7	1
122	62	20	C	160	0.0	0.0	0.0	0.0	0.0	21.3	0.0	0.0	6	1
122	64	28	A	140	16.0	22.1	0.0	0.0	0.0	0.0	1.0	0.3	5	1
122	64	27	B	140	1.0	0.3	0.0	0.0	0.0	1.1	0.0	0.0	1	1
122	64	27	A	160	0.0	0.0	0.0	0.0	0.0	11.2	0.0	0.0	1	1
122	64	28	D	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	64	27	C	80	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	6	1
122	64	33	B	160	5.0	4.5	0.0	0.0	2.6	0.0	0.0	0.0	6	1
122	64	33	C	80	3.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	33	D	70	1.0	6.4	0.0	0.0	1.1	0.0	0.0	0.0	6	1
122	64	34	C	160	0.0	0.0	0.0	0.0	1.4	1.9	0.0	0.0	1	1
122	64	26	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
122	64	26	A	160	2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	25	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	25	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	26	D	160	2.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	25	D	160	3.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	35	B	160	2.0	0.2	0.0	0.0	0.0	1.9	0.0	0.0	1	1
122	64	35	A	160	7.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	36	B	120	2.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	35	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	36	C	160	4.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	30	A	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	29	B	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	29	A	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	64	29	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	29	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	31	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	32	B	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	64	32	A	160	1.0	0.3	0.0	0.0	0.0	6.7	0.0	0.0	1	1
122	63	28	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	28	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	27	B	160	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0	6	1
122	63	27	A	160	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	1	1
122	63	28	C	160	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0	1	1
122	63	28	D	160	0.0	0.0	0.0	0.0	0.0	17.9	0.0	0.0	6	1
122	63	27	C	160	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	1	1
122	63	33	B	160	0.0	0.0	0.0	0.0	0.0	20.2	0.0	0.0	6	1
122	63	33	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	34	A	160	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	26	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	26	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	25	B	160	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	26	D	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	25	D	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1
122	63	36	B	40	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	36	A	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	36	C	120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	63	36	D	80	0.0	0.0	0.2	9.9	0.0	0.0	0.0	0.0	1	1
122	62	30	B	80	3.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	30	A	80	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	30	C	160	4.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1	1
122	62	30	D	150	1.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	29	C	140	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	29	D	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	31	A	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	32	B	60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	1
122	62	31	C	110	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	1	1
121	64	5	D	120	1.0	1.4	0.1	1.0	0.0	0.0	0.0	0.0	5	1
121	64	4	B	140	1.0	0.6	0.1	32.8	0.0	0.0	0.0	0.0	1	1
121	64	4	A	140	0.0	0.0	0.1	16.8	0.0	0.0	0.0	0.0	1	1
121	64	3	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
121	64	3	A	160	1.0	0.8	0.0	0.0	2.9	4.5	0.0	0.0	1	1
121	64	4	C	160	0.0	0.0	0.1	60.2	0.0	0.0	0.0	0.0	6	1
121	64	4	D	160	1.0	1.9	0.0	0.0	0.0	0.0	1.0	0.2	1	1
121	64	3	C	160	1.0	2.2	0.0	0.0	2.6	0.0	0.0	0.0	1	1
121	64	9	B	160	6.0	1.6	0.1	47.8	0.0	0.0	0.0	0.0	6	1
121	64	9	A	160	0.0	0.0	0.1	25.3	0.0	0.0	0.0	0.0	1	1
121	64	10	B	160	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	1	1
121	64	9	D	160	0.0	0.0	0.1	4.6	0.0	0.0	0.0	0.0	6	1
121	64	10	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	1
121	64	10	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
121	64	1	B	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
121	64	1	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
121	64	2	D	160	0.0	0.0	0.0	0.0	0.0	8.0	2.0	1.0	1	1
121	64	1	D	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
121	64	11	B	120	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1	1
121	64	11	A	140	4.0	0.6	0.0	0.0	0.0	0.3	0.0	0.0	1	1
121	64	11	C	160	0.0	0.0	0.0	0.0	0.0	10.4	1.0	0.2	1	1
121	64	11	D	160	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.1	1	1
121	63	7	B	80	2.0	0.5	0.0	0.0	0.0	1.4	0.0	0.0	1	1

120	61	31	C	160	2.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
120	61	31	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
120	61	28	B	160	4.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	5	2
120	61	28	C	160	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	65	3	D	160	1.0	0.3	0.0	0.0	0.0	1.0	0.3	7	3
119	65	11	B	160	1.0	0.3	0.0	0.0	10.2	0.0	0.0	7	3
119	65	12	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	65	12	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	3
119	64	6	B	80	3.0	0.2	0.0	0.0	0.0	0.0	0.0	6	3
119	64	5	B	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	5	D	160	1.0	0.2	0.1	96.8	0.0	0.0	1.0	0.2	6	3
119	64	5	C	160	0.0	0.0	0.1	2.7	0.0	0.0	0.0	0.0	1	3
119	64	7	B	80	0.0	0.0	0.1	12.0	0.0	4.5	0.0	0.0	6	3
119	64	6	C	160	0.0	0.0	0.5	62.6	0.0	0.0	0.0	0.0	6	3
119	64	5	A	160	0.0	0.0	0.1	70.4	0.0	0.0	1.0	0.2	6	3
119	64	6	D	160	8.0	2.9	0.1	62.7	0.0	0.0	0.0	0.0	1	3
119	64	7	A	160	3.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5	3
119	64	8	B	160	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	8	A	160	2.0	0.3	1.0	42.9	0.0	0.0	1.0	0.3	1	3
119	64	7	C	160	0.0	0.0	0.0	0.0	0.0	17.3	0.0	0.0	1	3
119	64	7	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	8	C	160	3.0	0.2	0.1	11.5	0.0	0.0	0.0	0.0	1	3
119	64	8	D	160	3.0	0.3	0.1	19.5	0.0	0.0	1.0	0.3	1	3
119	64	3	A	160	1.0	8.2	0.0	0.0	0.0	0.0	1.0	0.8	1	3
119	64	4	C	160	2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	9	B	160	2.0	0.5	0.0	0.0	0.0	0.0	2.0	0.5	1	3
119	64	9	C	160	3.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	10	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	2	B	160	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1	3
119	64	11	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	11	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	3
119	64	11	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	11	D	160	4.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	5	3
119	64	12	C	160	1.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	6	B	160	11.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	6	A	160	2.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	5	B	160	3.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	5	A	160	6.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	7	3
119	63	5	C	160	3.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	7	C	160	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	1	3
119	63	8	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	8	D	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	10	A	120	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	1	2
119	63	9	C	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	9	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	2
119	63	10	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	10	D	80	2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	2	D	80	4.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	12	A	160	4.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	6	A	160	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	5	B	160	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	5	A	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	6	D	160	1.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	5	C	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	5	D	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	7	B	160	5.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	8	B	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	8	A	160	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	7	C	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	8	C	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	8	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	4	A	160	0.0	0.0	0.0	0.0	5.8	0.0	0.0	0.0	5	2
119	62	3	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	4	C	160	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	4	D	160	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	1	2
119	62	3	C	160	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1	2
119	62	3	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	9	B	160	1.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	9	A	160	18.0	5.4	0.0	0.0	0.0	0.0	1.0	0.2	5	2
119	62	9	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	10	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	2	B	160	5.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	2	A	160	0.0	0.0	0.0	0.0	0.0	3.2	1.0	0.2	1	2
119	62	1	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	2	D	160	1.0	0.3	0.0	0.0	0.0	2.4	0.0	0.0	1	2
119	62	1	C	160	4.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	1	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	12	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	11	C	160	1.0	0.3	0.0	0.0	0.0	4.2	0.0	0.0	1	2
119	62	12	D	160	2.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	6	B	160	2.0	0.5	0.0	0.0	0.0	0.0	3.0	1.2	1	2
119	61	6	A	160	3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	6	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	6	D	160	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	5	C	80	11.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	7	B	160	1.0	2.9	0.0	0.0	0.0	0.0	2.0	0.5	1	2
119	61	7	A	80	3.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	7	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	7	D	80	1.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	8	C	80	6.0	6.4	0.0	0.0	0.0	0.0	0.7	0.2	1	2
119	65	11	A	80	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	6	3
119	65	24	A	80	3.0	0.8	0.0	0.0	0.0	5.8	0.0	0.0	6	3
119	65	24	C	160	7.0	4.7	0.0	0.0	0.0	0.0	0.0	0.0	6	3
119	65	24	D	80	8.0	2	0.0	0.0	0.0	5.6	0.0	0.0	6	3
119	64	18	B	160	0.0	0.0	0.0	0.0	0.0	15.2	1.0	0.3	6	3
119	64	18	A	160	3.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	18	C	80	1.0	0.3	0.0	0.0	0.0	6.9	1.0	0.3	1	3
119	64	18	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	17	C	160	0.0	0.0	0.0	0.0	0.0	11.5	0.0	0.0	1	3
119	64	19	B	160	24.0	4.5	0.0	0.0	0.0	17.1	0.0	0.0	6	3

119	64	19	A	160	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	1	3
119	64	20	B	160	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	1	3
119	64	20	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	19	C	160	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	1	3
119	64	19	D	160	2.0	0.3	0.0	0.0	0.0	9.0	0.0	0.0	1	3
119	64	20	C	160	2.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	20	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	15	C	160	4.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	21	B	160	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	21	A	160	3.0	23.4	0.0	0.0	0.0	0.0	0.0	0.0	5	3
119	64	22	B	160	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	21	C	160	5.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	21	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	22	D	160	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	13	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	13	A	160	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	13	D	160	0.0	0.0	0.0	0.0	0.0	1.0	0.3	1	3
119	64	23	E	160	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	5	3
119	64	23	A	160	2.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	24	B	160	4.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	24	A	160	2.0	1.1	0.0	0.0	0.0	2.0	0.5	1	3
119	64	23	C	160	2.0	1.3	0.0	0.0	0.0	1.0	0.8	5	3
119	64	23	D	160	2.0	1.3	0.0	0.0	0.0	0.0	0.0	1	3
119	64	24	C	160	1.0	0.8	0.0	0.0	0.0	0.0	0.0	5	3
119	64	24	D	160	6.0	5.3	0.0	0.0	0.0	0.0	0.0	1	3
119	64	13	C	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	3
119	63	18	B	160	0.0	0.0	0.0	0.0	0.0	3.8	1.0	0.3	1	3
119	63	18	A	160	4.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	17	B	160	2.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	18	C	160	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	1	3
119	63	18	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	19	B	160	2.0	1.9	0.0	0.0	0.0	3.0	1.0	0.3	1	3
119	63	19	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	63	19	C	160	2.0	0.3	0.0	0.0	0.0	3.0	0.0	0.0	1	3
119	63	16	B	120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	2
119	63	16	A	160	1.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	15	B	160	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	1	2
119	63	16	D	80	2.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	15	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	15	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	21	D	160	7.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	22	D	160	3.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	63	13	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	63	14	C	160	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	23	A	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	63	23	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	63	24	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	17	B	160	2.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	17	A	160	1.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	17	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	62	20	B	160	4.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	16	B	80	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	5	2
119	62	16	A	160	1.0	0.5	0.0	0.0	4.3	0.0	0.0	0.0	1	2
119	62	15	B	160	1.0	0.8	0.0	0.0	2.4	0.0	0.0	0.0	1	2
119	62	16	C	120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	16	D	160	1.0	0.3	0.0	0.0	2.7	0.0	1.0	0.2	1	2
119	62	21	B	160	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	21	A	160	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.3	5	2
119	62	21	C	160	2.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	14	B	160	1.0	4.0	0.0	0.0	0.0	0.0	1.0	0.3	1	2
119	62	24	B	160	22.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	62	24	A	160	2.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	61	18	A	160	4.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	18	D	160	4.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	61	19	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	19	A	160	1.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	19	D	160	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	5	2
119	61	20	C	120	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	61	20	D	80	1.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	1	2
119	65	25	B	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	3
119	65	25	C	80	3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	6	3
119	65	36	A	160	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	6	3
119	65	36	D	160	4.0	2.4	0.0	0.0	0.0	1.0	2.0	0.5	6	3
119	64	30	B	160	3.0	0.6	0.0	0.0	0.0	3.7	1.0	0.3	1	3
119	64	30	A	160	0.0	0.0	0.0	0.0	0.0	8.6	0.0	0.0	1	3
119	64	29	B	160	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	30	C	160	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	30	D	160	0.0	0.0	0.0	0.0	0.0	8.3	1.0	0.3	1	3
119	64	29	C	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	29	D	160	3.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	31	B	160	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	5	3
119	64	31	A	160	2.0	0.8	0.0	0.0	0.0	6.4	0.0	0.0	1	3
119	64	32	A	160	8.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	31	C	160	0.0	0.0	0.0	0.0	0.0	21.0	0.0	0.0	6	3
119	64	31	D	160	2.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	32	C	160	6.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	32	D	160	4.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	28	B	160	3.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	28	A	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	27	A	160	5.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0	5	3
119	64	28	C	160	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1	3
119	64	28	D	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	27	C	160	2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	27	D	160	2.0	1.1	0.0	0.0	0.0	0.0	1.0	0.2	1	3
119	64	33	B	160	1.0	1.1	0.0	0.0	1.5	0.0	0.0	0.0	1	3
119	64	33	A	160	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	1	3
119	64	34	B	160	1.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	34	A	160	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3
119	64	33	C	160	1.0	1.6	0.0	0.0	1.4	0.0	0.0	0.0	1	3
119	64	33	E	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	3